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Understanding how to evaluate functions at specific points is a fundamental aspect of algebra and calculus. When working with multiple functions, it's essential to know how to substitute values and simplify expressions accurately. In this article, we will explore how to evaluate the functions F(x) and G(x) at various points, providing step-by-step solutions and explanations. Whether you're a student preparing for exams or someone looking to strengthen your algebra skills, this guide will help you master the process of finding function values efficiently.

Understanding the Functions F(x) and G(x)

Before diving into calculations, let's analyze the given functions:

Function F(x)

- Defined as $F(x) = 2x^2 + x - 3$
- This is a quadratic function, involving a squared term, a linear term, and a constant.

Function G(x)

- Defined as $G(x) = (2x - 1)/3$
- This is a linear function, representing a straight line when graphed.

Knowing the structure of these functions helps predict how their values will change based on the input x.

How to Find the Values of F(x) and G(x)

The process involves substituting specific x-values into each function and simplifying the expressions. Let's go through this step-by-step.

Step 1: Choose the x-values

Typically, the problem will specify certain x-values at which to evaluate the functions. For example, let's evaluate at $x = 1$, $x = -2$, and $x = 0$.

Step 2: Substitute the x-value into each function

- For F(x), replace every x with the chosen value.
- For G(x), do the same.

Step 3: Simplify the expression

- Perform algebraic operations, following order of operations (PEMDAS).
- For quadratic functions, square the x-value first, then multiply, add, or subtract accordingly.
- For linear functions, multiply first, then add or subtract.

Example Calculations

Let's now evaluate the functions at specific points: $x = 1$, $x = -2$, and $x = 0$.

Evaluating at x = 1

- **F(1):**
  - Substitute $x = 1$: $F(1) = 2(1)^2 + 1 - 3$
  - Calculate: $2(1) + 1 - 3 = 2 + 1 - 3$
  - Simplify: $3 - 3 = 0$

  Therefore, $F(1) = 0$.

- **G(1):**
  - Substitute $x = 1$: $G(1) = (2(1) - 1)/3$
  - Calculate numerator: $2 - 1 = 1$
  - Simplify: $1/3$

  Therefore, $G(1) = 1/3$.

Evaluating at $x = -2$

- **F(-2):**
  - Substitute $x = -2$: $F(-2) = 2(-2)^2 + (-2) - 3$
  - Calculate: $2(4) - 2 - 3 = 8 - 2 - 3$
  - Simplify: 6

  Therefore, $F(-2) = 6$.

- **G(-2):**
  - Substitute $x = -2$: $G(-2) = (2(-2) - 1)/3$
  - Calculate numerator: $-4 - 1 = -5$
  - Simplify: $-5/3$

  Therefore, $G(-2) = -5/3$.

Evaluating at $x = 0$

- **F(0):**
  - Substitute $x = 0$: $F(0) = 2(0)^2 + 0 - 3$
  - Calculate: $0 + 0 - 3 = -3$

  Therefore, $F(0) = -3$.

- **G(0):**
  - Substitute $x = 0$: $G(0) = (2(0) - 1)/3$

  - Calculate numerator: 0 - 1 = -1
  - Simplify: -1/3

  Therefore, G(0) = -1/3.

Additional Examples: Finding Function Values at Other Points

To deepen your understanding, let's evaluate the functions at additional points, such as x = 3 and x = -1.

At x = 3

- **F(3):**
  - F(3) = 2(3)^2 + 3 - 3
  - Calculate: 2(9) + 3 - 3 = 18 + 3 - 3
  - Simplify: 18

  Therefore, F(3) = 18.

- **G(3):**
  - G(3) = (2(3) - 1)/3
  - Calculate numerator: 6 - 1 = 5
  - Simplify: 5/3

  Therefore, G(3) = 5/3.

At x = -1

- **F(-1):**
    - F(-1) = 2(-1)^2 + (-1) - 3
    - Calculate: 2(1) - 1 - 3 = 2 - 1 - 3
    - Simplify: -2

  Therefore, F(-1) = -2.

- **G(-1):**
    - G(-1) = (2(-1) - 1)/3
    - Calculate numerator: -2 - 1 = -3
    - Simplify: -3/3 = -1

  Therefore, G(-1) = -1.

Summary of Key Steps in Evaluating Functions

To efficiently find the value of functions at specific points, follow these steps:

1. Identify the function and the input x-value.
2. Substitute the x-value into the function expression.
3. Apply order of operations to simplify the expression:

    - Calculate exponents first.
    - Perform multiplication and division from left to right.
    - Add and subtract as needed.

4. Write the simplified result as the function value at that x.

Applying this method ensures accurate and quick evaluations.

Practical Applications of Function Evaluation

Knowing how to evaluate functions at various points is crucial in many real-world scenarios, including:

- Calculating profit or loss based on cost functions.
- Determining the position of an object in physics using position functions.
- Predicting growth in finance using quadratic or linear models.
- Analyzing data trends by plugging in specific data points.

Mastering the evaluation process enhances problem-solving skills across different disciplines.

Conclusion

Evaluating functions like $F(x) = 2x^2 + x - 3$ and $G(x) = (2x - 1)/3$ at specific points is a straightforward process once you

Frequently Asked Questions

What is the value of F(2) for the function F(x) = 2x^2 + x - 3?

Substitute x = 2 into F(x): F(2) = 2(2)^2 + 2 - 3 = 2(4) + 2 - 3 = 8 + 2 - 3 = 7.

Calculate G(4) for the function G(x) = (2x - 1) / 3.

Substitute x = 4 into G(x): G(4) = (2(4) - 1) / 3 = (8 - 1) / 3 = 7 / 3.

Find the value of F(-1).

Substitute x = -1 into F(x): F(-1) = 2(-1)^2 + (-1) - 3 = 2(1) - 1 - 3 = 2 - 1 - 3 = -2.

Evaluate G(0).

Substitute x = 0 into G(x): G(0) = (2(0) - 1) / 3 = (-1) / 3.

What is F(3)?

Substitute x = 3 into F(x): F(3) = 2(3)^2 + 3 - 3 = 2(9) + 3 - 3 = 18 + 3 - 3 = 18.

Determine G(5).

Substitute x = 5 into G(x): G(5) = (2(5) - 1) / 3 = (10 - 1) / 3 = 9 / 3 = 3.

Additional Resources

In-Depth Analysis and Solution of Functions F(x) and G(x)

Understanding and evaluating functions is a fundamental aspect of algebra and calculus, providing the foundation for more advanced mathematical concepts. In this comprehensive review, we will thoroughly analyze the functions:

- $F(x) = 2x^2 + x - 3$
- G(x) = (2x - 1) / 3

Our goal is to find specific values of these functions based on given inputs, explore their properties, and understand how to approach such problems systematically. This piece aims to guide readers through the step-by-step process, ensuring clarity and depth at each stage.

Overview of Functions and Their Significance

Functions are mathematical relationships that assign exactly one output to each input within a domain. They are essential tools across mathematics, physics, engineering, and computer science, helping model real-world phenomena such as motion, growth, decay, and more.

In this context:
- $F(x) = 2x^2 + x - 3$ is a quadratic function, with a parabola shape when graphed. Its properties include symmetry, a vertex, and a parabola opening upward because the coefficient of x^2 is positive.
- G(x) = (2x - 1) / 3 is a linear function, representing a straight line when graphed, with a constant rate of change.

Understanding these functions allows us to evaluate their values at specific points, analyze their behavior, and interpret their significance.

Analyzing the Function $F(x) = 2x^2 + x - 3$

1. Nature of the Function

- Quadratic Function: The degree of the polynomial is 2.
- Standard Form: $F(x) = ax^2 + bx + c$, where a=2, b=1, c=-3.
- Shape: Parabola opening upward (since a>0).

2. Vertex of the Parabola

- The vertex provides the maximum or minimum point.
- To find the vertex, use the formula for x-coordinate: x = -b / (2a).

Calculating:
x_vertex = -1 / (2 2) = -1 / 4 = -0.25

- To find the y-coordinate:
$F(-0.25) = 2(-0.25)^2 + (-0.25) - 3$
= 2(0.0625) - 0.25 - 3
= 0.125 - 0.25 - 3
= -0.125 - 3
= -3.125

Vertex Coordinates: (-0.25, -3.125)

Since a>0, this point is the minimum of the parabola.

3. Axis of Symmetry

- The axis of symmetry passes through the vertex:
x = -b / (2a) = -0.25

4. Y-Intercept

- When x=0:
F(0) = 2(0) + 0 - 3 = -3

5. X-Intercepts (Roots of F(x))

Set F(x) = 0:
$2x^2 + x - 3 = 0$

Using quadratic formula:
$x = [-b \pm \sqrt{(b^2 - 4ac)}] / (2a)$

Calculations:
Discriminant (D) = $b^2 - 4ac = 1^2 - 42(-3) = 1 + 24 = 25$

Square root of D = 5

Now,
$x = [-1 \pm 5] / (22) = [-1 \pm 5] / 4$

- For the positive root:
$x = (4)/4 = 1$
- For the negative root:
$x = (-6)/4 = -1.5$

X-intercepts are at x=1 and x=-1.5.

Evaluating the Function F at Specific Values

Suppose the problem asks us to find F(x) at certain points, such as x=2, x=-1, or any other value. The general approach involves substituting the value into the expression for F(x).

Example calculations:

- At x=2:
$F(2) = 2(2)^2 + 2 - 3 = 2(4) + 2 - 3 = 8 + 2 - 3 = 7$
- At x=-1:
$F(-1) = 2(1) -1 - 3 = 2(1) - 1 - 3 = 2 - 1 - 3 = -2$

These evaluations are straightforward but require careful arithmetic to avoid errors.

Analyzing the Function G(x) = (2x - 1)/3

1. Nature of the Function
- Linear Function: Degree 1.
- Standard Form: $G(x) = (2/3)x - 1/3$.

2. Slope and Y-Intercept

- Slope (m) = 2/3, indicating that for every increase of 1 in x, G(x) increases by 2/3.
- Y-intercept occurs at x=0:
$G(0) = (20 - 1)/3 = -1/3$.

3. Graph Characteristics

- Straight line with positive slope.
- Crosses the y-axis at -1/3.
- X-intercept: set G(x)=0, solve for x:
$0 = (2x - 1)/3$
Multiply both sides by 3:
$0 = 2x - 1$
$x= 1/2$

- This indicates the line crosses the x-axis at x=0.5.

4. Evaluating G(x) at Specific Values

- At x=2:
$G(2) = (22 - 1)/3 = (4 - 1)/3 = 3/3 = 1$
- At x=-1:
$G(-1) = (2(-1) - 1)/3 = (-2 - 1)/3 = -3/3 = -1$

Systematic Approach to Find Values of Functions

When tasked with finding values of functions at specific points, the key is to follow a systematic process:

Step 1: Identify the given function and the point(s) at which to evaluate.

Step 2: Substitute the value(s) into the function expression.

Step 3: Simplify the expression carefully, maintaining order of operations (PEMDAS/BODMAS).

Step 4: Interpret the result, noting whether it is positive, negative, or zero, and what that implies.

Step 5: For quadratic functions, consider additional properties such as roots, vertex, and axis of symmetry, which may help understand the behavior around the evaluated point.

Additional Concepts Related to Function Evaluation and Analysis

1. Domain and Range

- For $F(x)$: Domain is all real numbers, as squares and polynomials are defined everywhere.
- Range: Since it opens upward, the minimum value is at the vertex (-3.125), so the range is $[-3.125, \infty)$.

- For $G(x)$: Domain is all real numbers, as linear functions are defined everywhere.
- Range: All real numbers, since the line extends infinitely in both directions.

2. Function Composition

- Sometimes, evaluating compositions such as $F(G(x))$ or $G(F(x))$ provides deeper insights.
- For example, $F(G(x))$:

Substitute $G(x)$ into F:
$F(G(x))= 2[(2x - 1)/3]^2 + [(2x - 1)/3] - 3$

This involves expanding and simplifying, which can be complex but illustrates how functions can be combined.

3. Inverse Functions

- Finding the inverse involves solving for x in terms of y.
- For $G(x)$:

$y = (2x - 1)/3$
Multiply both sides by 3:
$3y = 2x - 1$
Add 1:
$3y + 1 = 2x$
Divide by 2:
$x = (3y + 1)/2$

Therefore, $G^{-1}(y) = (3y + 1)/2$.

- For $F(x)$, the inverse involves solving quadratic equations, which may be more involved.

Practical Applications and Real-World Contexts

Understanding how to evaluate functions like $F(x)$ and $G(x)$ is essential in various disciplines:

- Physics: Quadratic functions model projectile motion. For example, F(x) could represent the height of an object over time.
- Economics: Linear functions are used to model cost or revenue functions.
- Engineering: Designing systems often involves evaluating functions at specific points to determine system behavior.

Summary and Final Remarks

In this detailed exploration, we have:

- Examined the properties of quadratic and linear functions.
- Calculated key features such as vertex, intercepts

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